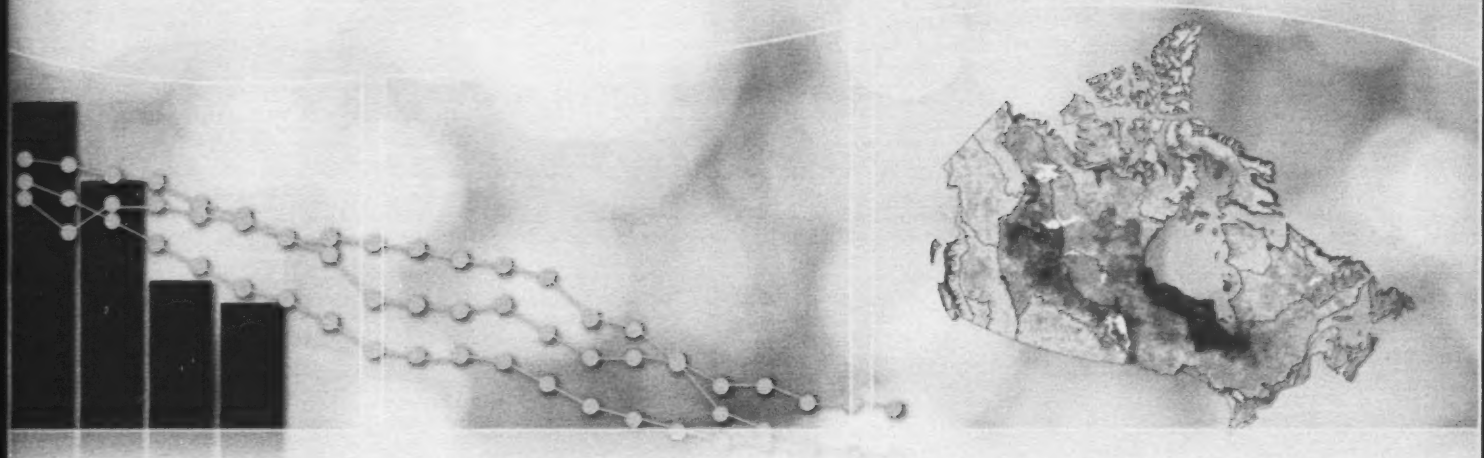
Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canadian Environmental Sustainability Indicators

Drinking water advisories



Canada

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Canadian Environmental Sustainability Indicators

Drinking water advisories

June 2018

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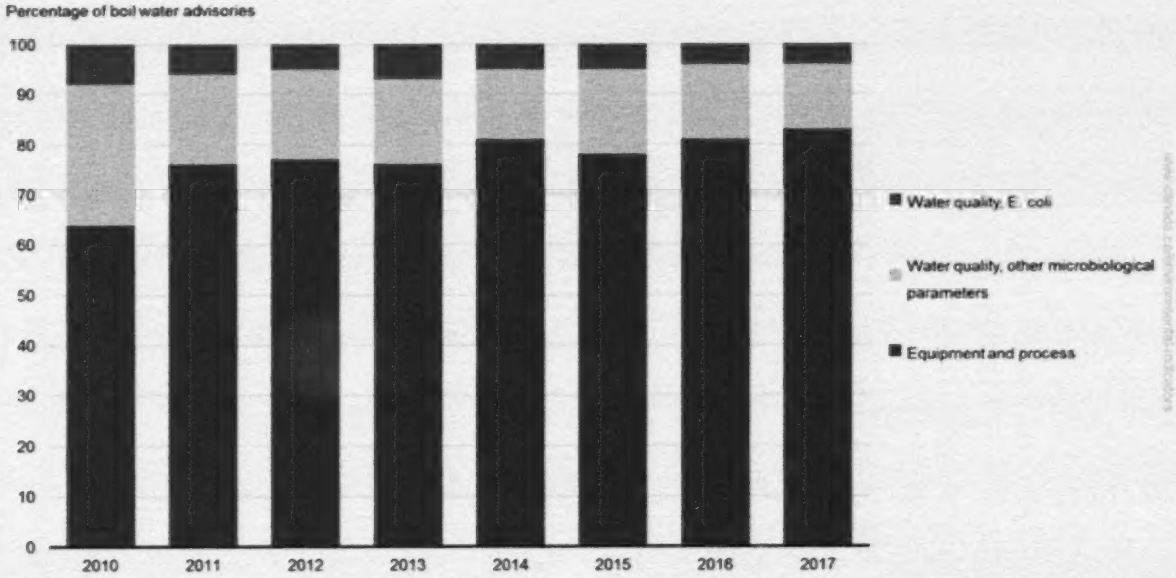
Drinking water advisories

Drinking water advisories are public health protection messages about real or potential health risks related to drinking water. These indicators provide a long-term view of why boil water advisories are issued. They also show the relationship between community size and the frequency of boil water advisories.

Key results

- In 2017:
  - 4% of boil water advisories were due to the detection of Escherichia coli (E. coli)
  - 13% were due to other microbiological water quality parameters
  - the remaining 83% were due to equipment and process-related problems
- Between 2010 and 2017, the number of boil water advisories issued on a precautionary basis, due to problems with equipment or processes, increased

Figure 1. Causes of boil water advisories, Canada, 2010 to 2017



Data for Figure 1

Note: Data used in this indicator come from various agencies and jurisdictions across Canada that use or share information with the Canadian Network for Public Health Intelligence's Drinking Water Advisories application. They represent only a subset (less than 50%) of the Canadian population. Comprehensive national data are not available. See the Data sources and methods section for more detail. The Water quality, other microbiological parameters category includes detection of total coliform bacteria and high turbidity levels in drinking water systems. The Equipment and process category includes issues such as broken water mains, planned system maintenance, power failures or equipment problems.
Source: Canadian Network for Public Health Intelligence (2018) Drinking Water Advisories application.

Drinking water advisories are generally precautionary, meaning they are typically issued before drinking water quality problems occur. The advisories can take 3 forms: Do not consume, Do not use and Boil water. Boil water advisories are by far the most common type of advisory. They are issued as a means to inform consumers that they need to boil their water in order to protect their health against the potential presence of disease-causing bacteria, viruses or parasites. Each year, boil water

advisories represent about 98% of the advisory data. Therefore, this analysis looks only at this type of advisories.

Most boil water advisories are issued because the equipment and processes used to treat, store or distribute drinking water break down, require maintenance, or have been affected by environmental conditions. In 2017, this accounted for 83% of boil water advisories.

The category Water quality, E. coli includes boil water advisories issued due to the detection of E. coli in drinking water samples, which indicates the potential presence of disease-causing bacteria, viruses or parasites in the water. In 2017, E. coli-related boil water advisories accounted for 4% of the total, which remains consistent with most previous years.

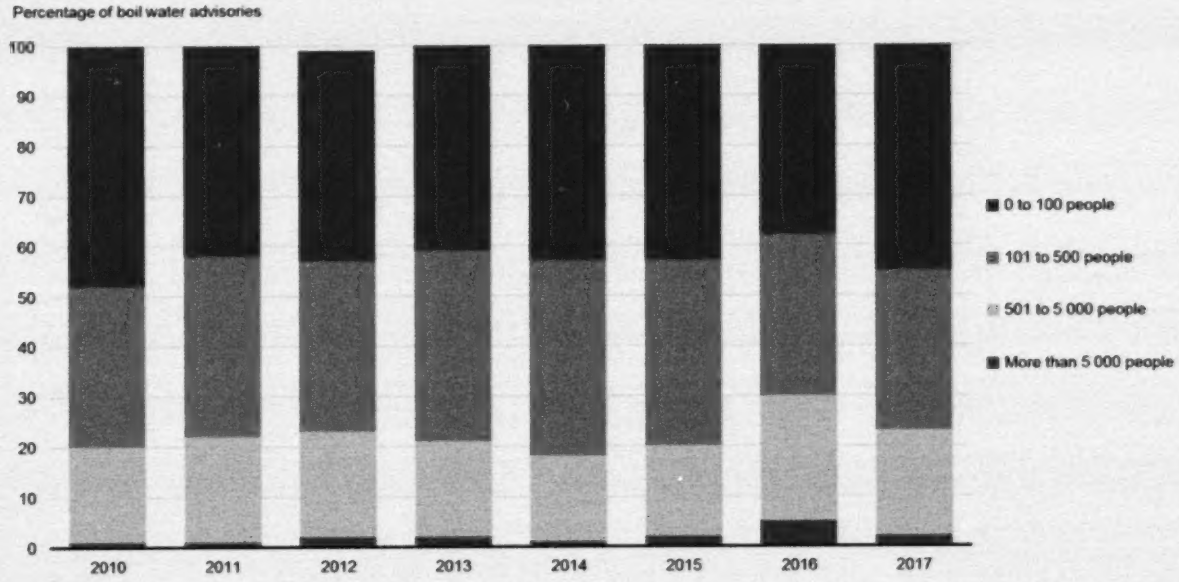
The category Water quality, other microbiological parameters includes boil water advisories issued due to the detection of total coliform bacteria or elevated turbidity levels in drinking water. These parameters are not directly linked to health but provide an indication of changing conditions within a drinking water system. This category accounted for 13% of boil water advisories in 2017.

Drinking water advisories by community size

Key results

- In 2017, 77% of boil water advisories were issued for drinking water systems serving 500 people or less

Figure 2. Boil water advisories by community size, Canada, 2010 to 2017



Data for Figure 2

Note: Data used in this indicator come from various agencies and jurisdictions across Canada that use or share information with the Canadian Network for Public Health Intelligence's Drinking Water Advisories application. They represent only a subset (less than 50%) of the Canadian population. Comprehensive national data are not available. See the Data sources and methods section for more detail.
Source: Canadian Network for Public Health Intelligence (2018) Drinking Water Advisories application.

Between 2010 and 2017, the majority of boil water advisories were issued in communities of 500 or fewer people. Boil water advisories are more common in small communities because of the unique

challenges those communities face, including limited operational capacity. For example, a broken water main in a larger city is usually isolated and repaired quickly by well-equipped staff with no need for a boil water advisory. In a village, the same problem may take longer to fix and a boil water advisory may be issued while repairs are completed.

Annual variations in the proportion of boil water advisories issued for communities of a specific size may be explained by several factors, including:

- Many communities have populations around the 500 or 5 000 mark. A community's population may fluctuate from one side of the category boundary to the other.
- Approximately 50% of advisories each year are due to broken water mains or planned maintenance work on distribution systems. These are often localized in an affected sub-area of a bigger municipal distribution system. Some agencies will estimate and report on the size of the population affected in the localized area only (because the advisory does not apply to other parts of the town or city), whereas others will report on the overall population served by the entire distribution system, even if only a portion is affected.

About the indicators

What the indicators measure

The Drinking water advisories indicators provide a long-term view of the main reasons why boil water advisories are issued, namely:

- due to the detection of Escherichia coli (E. coli), which suggests the possible presence of disease-causing microorganisms in drinking water
- as a precaution, due to elevated levels of other, non-health-related water quality indicators
- as a precaution, due to equipment and process-related issues

They also report on the relationship between community size and the percentage of boil water advisories issued each year. The indicators exclude "Do not consume" and "Do not use" advisories, which represent approximately 2% of all drinking water advisories in Canada annually.

Why these indicators are important

Drinking water advisories are public health protection messages issued by public health or regulatory authorities. They inform consumers about actions they should take to protect themselves from real or potential health risks related to their drinking water supply.

Although Canada's drinking water is among the safest in the world,[1] better understanding key trends related to drinking water advisories helps identify priorities for drinking water infrastructure and operations. This information helps foster consistency and coordination of efforts to enhance drinking water safety and the sustainability of drinking water infrastructure across the country.

Related indicators

The Water quality in Canadian rivers indicators rank water quality at monitoring sites across Canada where human activity is likely to impair water quality in its ability to support plants and animals.

The Nutrients in the St. Lawrence River and Nutrients in Lake Winnipeg indicators report the state of phosphorus and nitrogen levels in those 2 ecosystems.

The Phosphorus levels in the offshore waters of the Great Lakes indicator reports on the state of and trends in phosphorus levels in the open waters of the Canadian Great Lakes.

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[1] World Health Organization (2009) Country profiles of environmental burden of disease: Canada (PDF; 68 kB). Quantifying environmental health impacts. Retrieved on January 24, 2018.

Clean drinking water

These indicators support the measurement of progress towards the following 2016–2019 Federal Sustainable Development Strategy long-term goal: All Canadians have access to safe drinking water and, in particular, the significant challenges Indigenous communities face are addressed.

Data sources and methods

Data sources

Data used in these indicators originate from various agencies and jurisdictions across Canada, using or sharing information with the Canadian Network for Public Health Intelligence Drinking Water Advisories application, and were drawn from the database. Given that this is a relatively new surveillance tool, the data do not currently represent all jurisdictions. However, the results are representative of key drinking water needs and issues in Canada.

Data for these indicators cover the period from January 1, 2010 to December 31, 2017. They represent all boil water advisories issued by participating jurisdictions and agencies included in the Drinking Water Advisories application for that period.

The indicators are reported biennially, but data are contributed to the application by participating agencies when the advisories are issued, or shortly thereafter. The Drinking water advisories indicators are calculated using the most recent data available at the time when the indicator is produced. As new agencies begin to use the application, they may choose to add historic data to the system. In such cases, the historic data are included in the appropriate year.

More information

The Canadian Network for Public Health Intelligence provides a suite of secure surveillance and alerting applications for use by federal, provincial and territorial health protection agencies. The Network's Drinking Water Advisories application has been created to meet the needs of the agencies responsible for overseeing the safety of drinking water. The application enables them to manage and share information to coordinate response efforts during a drinking water incident. It also helps capture, analyze and report on the context of drinking water advisories so that lessons can be learned and priorities identified.

In Canada, provincial and territorial governments are responsible for overseeing the safety of drinking water. Drinking water advisory data are generated by regulatory agencies as the advisories are issued. When an advisory is issued, the Drinking Water Advisories application helps the regulatory agency quickly communicate it to personnel at the local and regional level while capturing key information describing the incident. The system helps agencies communicate information to the public quickly and allows for analysis of accumulated drinking water advisory data to reveal key trends such as water quality or operational reasons for the advisories and the characteristics of the drinking water systems or communities affected.

These indicators focus on boil water advisories as they are the most common type of drinking water advisory and represent the vast majority of the data. "Do not consume" and "Do not use" advisories represent approximately 2% of advisories each year. They may be issued in response to operational issues or when a chemical contaminant is suspected, or confirmed, in the drinking water system. They may also be issued when conditions would otherwise call for a boil water advisory but where boiling is not practical, such as at school water fountains. Given the variation in their use and the rarity of "Do not consume" and "Do not use" advisories, they are excluded from the indicators. Boil water advisories can be considered representative of the general situation in Canada with respect to drinking water advisories.

Methods

The reasons for issuing boil water advisories are organized into 3 categories:

1) Water quality, E. coli
2) Water quality, other microbiological parameters
3) Equipment and process

These categories represent a consolidation of the broad array of more detailed water quality reasons captured by the Drinking Water Advisories application (Table 1). Figure 3 shows how all individual reasons contributed to the issuance of boil water advisories.

Most boil water advisories are issued because the equipment and processes used to treat, store or distribute drinking water break down, require maintenance, or have been affected by environmental conditions. This includes issues such as broken water mains, planned system maintenance, power failures or equipment problems. In some cases, extreme weather or heavy rains may cause the quality of surface or ground water sources to temporarily worsen, challenging the drinking water treatment system. Boil water advisories issued for equipment and process-related reasons are generally issued before any actual decline in drinking water quality occurs and are in place until conditions return to normal.

E. coli is naturally found in the digestive systems of all warm-blooded birds and animals, including humans, and is commonly found in lakes and rivers. However, its presence in treated drinking water indicates fecal contamination by, for example, raw sewage or manure. Some strains of E. coli can cause stomach illness and more serious health problems in humans.

The category "Water quality, other microbiological parameters" identifies advisories issued due to changing conditions inside the drinking water system that typically do not represent a health risk to consumers. This category includes total coliform bacteria and turbidity. Total coliforms are a broad family of bacteria commonly found in the environment. Turbidity is a measure of the cloudiness of water caused by particles. When unusual or elevated levels of these water quality parameters are measured in the drinking water system, the cause is investigated and the findings may contribute to the decision to issue a boil water advisory.

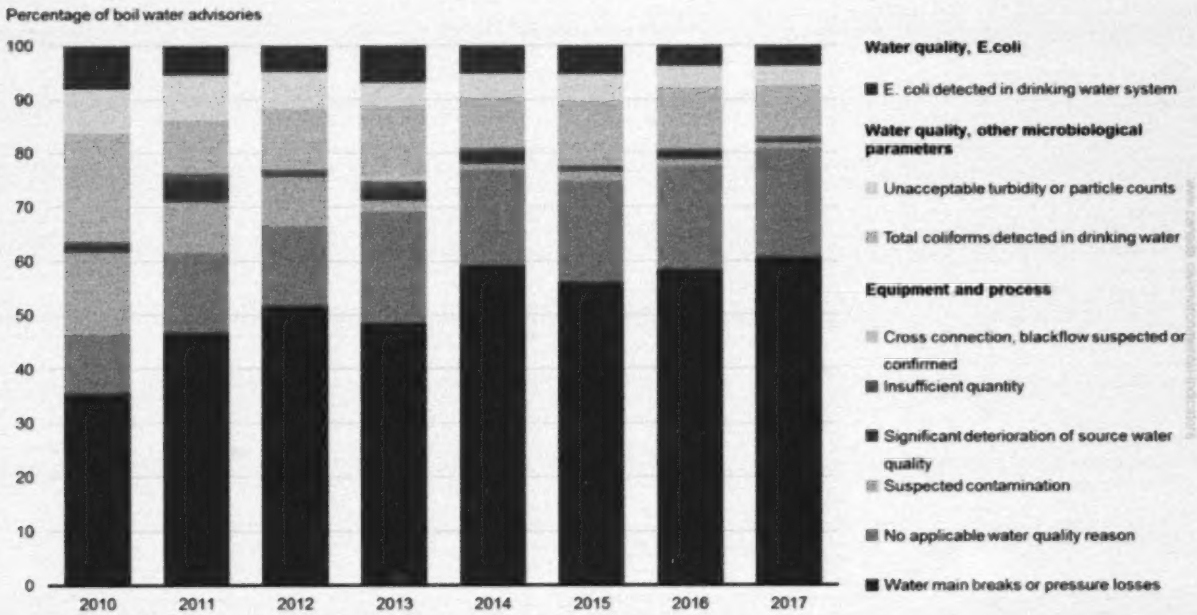
To calculate the indicators for each year, all boil water advisories in the Drinking Water Advisories application were categorized. The number of boil water advisories in each category were then summed and divided by the total number of boil water advisories captured by the application.

Table 1. Categories of drinking water advisories used in the indicators

Indicator category	Reason	Definition
Water quality, E. coli	E. coli detected in drinking water system	The chief bacterial indicator of drinking water safety. Its presence indicates recent fecal contamination and the possible presence of disease-causing micro-organisms in drinking water.
Water quality, other microbiological criteria	Unacceptable turbidity or particle counts	A measure of the cloudiness of water caused by suspended particles. Provides information on the effectiveness of treatment and helps identify changing conditions in the drinking water system.
Water quality, other microbiological criteria	Total coliforms detected in drinking water system	Common environmental bacteria used to assess general conditions within the drinking water system. Also provides information on the effectiveness of treatment.

Indicator category	Reason	Definition
Equipment and process	Water main breaks or pressure losses	Includes instances when distribution system pipes break resulting in a breach of integrity, leakage and loss of system pressure. It also includes system pressure losses due to maintenance work, power failures or depleted reservoir storage.
Equipment and process	Suspected contamination	Used when contamination is suspected due to observed operational conditions, not test results.
Equipment and process	No applicable water quality reason	Used when an advisory is issued solely for operational reasons with no observed water quality issues.
Equipment and process	Insufficient quantity	Used when the capacity of water storage is depleted resulting in a potential loss of pressure in the drinking water system.
Equipment and process	Significant deterioration of source water quality	Used when a decline in source water quality has potentially impacted drinking water quality.
Equipment and process	Cross-connection, backflow suspected or confirmed	Applies to inappropriate connections to a drinking water system resulting in potential contamination of drinking water.

Figure 3. Percentage of boil water advisories grouped by the reason for issuance, Canada, 2010 to 2017



Data for Figure 3

Note: Data used in this indicator come from various agencies and jurisdictions across Canada and represent a subset of the Canadian population.
Source: Canadian Network for Public Health Intelligence (2018) Drinking Water Advisories application.

Recent changes

As new agencies adopt the Drinking Water Advisories application, they may add retrospective data to the system; results for 2010 to 2015 have been revised accordingly.

In this update, the reason "Exceedance of maximum allowable concentrations or drinking water standard" was removed as a reason for issuing a boil water advisory. Although used infrequently, this reason was found to be too generic and its use too variable, as it included both equipment and process-related issues and issues such as turbidity, detection of total coliforms or E. coli. In the current iteration of the indicators, experts have reviewed each individual boil water advisory record citing the reason "Exceedance of maximum allowable concentrations or drinking water standard" in order to find the actual cause of the advisory and to place it in the right category. The advisories previously attributed to this reason are now placed in their respective categories. The data for previous years have been revised accordingly. Therefore, this update may show slightly different data from the previous update.

Caveats and limitations

The Canadian Network for Public Health Intelligence Drinking Water Advisories application is a national tool developed and enhanced over time through partnerships and collaborative work involving federal, provincial and territorial partners. The front-line users of the system are the regulatory and health protection agencies who oversee drinking water safety. The data in the system belong to these agencies, as they created that data in the course of their oversight activities.

The Drinking Water Advisories application became a live surveillance and alerting tool in 2008. The number of agencies using the system is growing each year, and the end goal for the Drinking water advisories indicators is to represent the full national picture. Although this has not yet been achieved, the data are representative of prevailing trends in a variety of regions across Canada and provide useful insight into issues that challenge the delivery of safe drinking water.

The Drinking water advisories indicators present an overall view of the trends emerging in the system, rather than focusing on the specific data for any particular province, territory or agency. Percentages reported in these indicators may differ from previous and future publications as historic data are added to the system and as new agencies adopt the application.

Resources

References

Health Canada (2009) Guidance for Issuing and Rescinding Drinking Water Avoidance Advisories in Emergency Situations. **Retrieved on January 24, 2018.**

Health Canada (2012) Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Escherichia coli. **Retrieved on January 24, 2018.**

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Health Canada (2012) Our Health, Our Environment: A Snapshot of Environmental Health in Canada. **Retrieved on January 24, 2018.**

Health Canada (2015) Guidance for Issuing and Rescinding Boil Water Advisories in Canadian Drinking Water Supplies. **Retrieved on January 24, 2018.**

Annex

Annex A. Data tables for the figures presented in this document

Table A.1. Data for Figure 1. Causes of boil water advisories

Year	Water quality, E. coli (percentage of boil water advisories)	Water quality, other microbiological parameters (percentage of boil water advisories)	Equipment and process (percentage of boil water advisories)
2010	8	28	64
2011	5	18	77
2012	5	18	77
2013	7	17	76
2014	5	14	81
2015	5	17	78
2016	4	15	81
2017	4	13	83

Note: Data used in this indicator come from various agencies and jurisdictions across Canada that use or share information with the Canadian Network for Public Health Intelligence's Drinking Water Advisories application. They represent only a subset (less than 50%) of the Canadian population. Comprehensive national data are not available. See the Data sources and methods section for more detail. The Water quality, other microbiological parameters category includes detection of total coliform bacteria and high turbidity levels in drinking water systems. The Equipment and process category includes issues such as broken water mains, planned system maintenance, power failures or equipment problems.
Source: Canadian Network for Public Health Intelligence (2018) Drinking Water Advisories application.

Table A.2. Data for Figure 2. Figure 2. Boil water advisories by community size, Canada, 2010 to 2017

Year	0 to 100 people (percentage of boil water advisories)	101 to 500 people (percentage of boil water advisories)	501 to 5 000 people (percentage of boil water advisories)	More than 5 000 people (percentage of boil water advisories)
2010	48	32	19	1
2011	43	36	21	1
2012	42	34	21	2
2013	41	38	19	2
2014	43	39	17	1
2015	43	37	18	2
2016	38	32	25	5
2017	45	32	21	2

Note: Data used in this indicator come from various agencies and jurisdictions across Canada that use or share information with the Canadian Network for Public Health Intelligence's Drinking Water Advisories application. They represent only a subset (less than 50%) of the Canadian population. Comprehensive national data are not available. See the Data sources and

methods section for more detail.
Source: Canadian Network for Public Health Intelligence (2018) Drinking Water Advisories application.

Table A.3. Data for Figure 3. Percentage of boil water advisories grouped by the reason for issuance, Canada, 2010 to 2017

Reason for boil water advisory	General category of reason for boil water advisory	2010 (percentage of boil water advisories)	2011 (percentage of boil water advisories)	2012 (percentage of boil water advisories)	2013 (percentage of boil water advisories)	2014 (percentage of boil water advisories)	2015 (percentage of boil water advisories)	2016 (percentage of boil water advisories)	2017 (percentage of boil water advisories)
E. coli detected in drinking water system	Water quality, E. coli	8.1	5.5	4.9	7.0	5.3	5.4	3.9	3.9
Unacceptable turbidity or particle counts	Water quality, other microbiological parameters	8.1	8.3	6.8	4.3	4.4	5.0	4.0	3.6
Total coliforms detected in drinking water	Water quality, other microbiological parameters	19.9	9.9	11.0	12.7	9.1	11.7	11.2	9.0
Cross connection, backflow suspected or confirmed	Equipment and process	0.2	0.0	0.3	1.2	0.2	0.2	0.2	0.4
Insufficient quantity	Equipment and process	0.8	1.4	1.1	1.6	0.8	0.7	0.5	0.8
Significant deterioration of source water quality	Equipment and process	1.2	4.0	0.3	2.0	2.2	0.5	1.4	0.5
Suspected contamination	Equipment and process	15.3	9.3	9.1	2.0	1.1	1.7	1.2	1.1
No applicable water quality reason	Equipment and process	10.9	14.8	14.8	20.7	17.7	18.8	19.1	20.0
Water main breaks or pressure losses	Equipment and process	35.5	46.8	51.7	48.5	59.2	56.0	58.5	60.7

Note: Data used in this indicator come from various agencies and jurisdictions across Canada and represent a subset of the Canadian population.
Source: Canadian Network for Public Health Intelligence (2018) Drinking Water Advisories application.

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